2016 Climate Review for Puerto Rico and the U.S. Virgin Islands.

Synopsis: *Near normal rainfall was observed across Puerto Rico the first half of 2016 with extremely wet conditions observed during late fall. Warm to hot temperatures were observed across the area. Near to slightly above normal rainfall was observed across St Croix, although Henry E. Rohlsen Airport in St Croix reported below normal rainfall. Near normal rainfall was observed across St Thomas.*

Near to above normal rainfall was observed across most of Puerto Rico with warm to hot temperatures. Based on the **A**dvance **H**ydrologic **P**rediction **S**ervice (AHPS), a surplus of 15 to 20+ inches was reported across western and northern PR (Fig 2), with some areas across the southeast and the eastern interior of the island reporting 50 to 90 percent of its normal rainfall. Based on the Cooperative Observer Network Data (COOP), a preliminary island-wide rainfall total of 74.21 inches was reported, which is 11.71 inches above the normal rainfall (Table 1). 34.33 and 45.79 inches were reported across St Thomas/St John and St Croix, respectively (island-wide). This is around 80 and 115 percent of its normal rainfall, respectively. For rainfall accumulation and percent of normal per climate division visit: http://www.weather.gov/sju/averagerainfall. For the driest and wettest years on record visit: http://www.weather.gov/media/sju/climo/stats/TopYears.pdf.

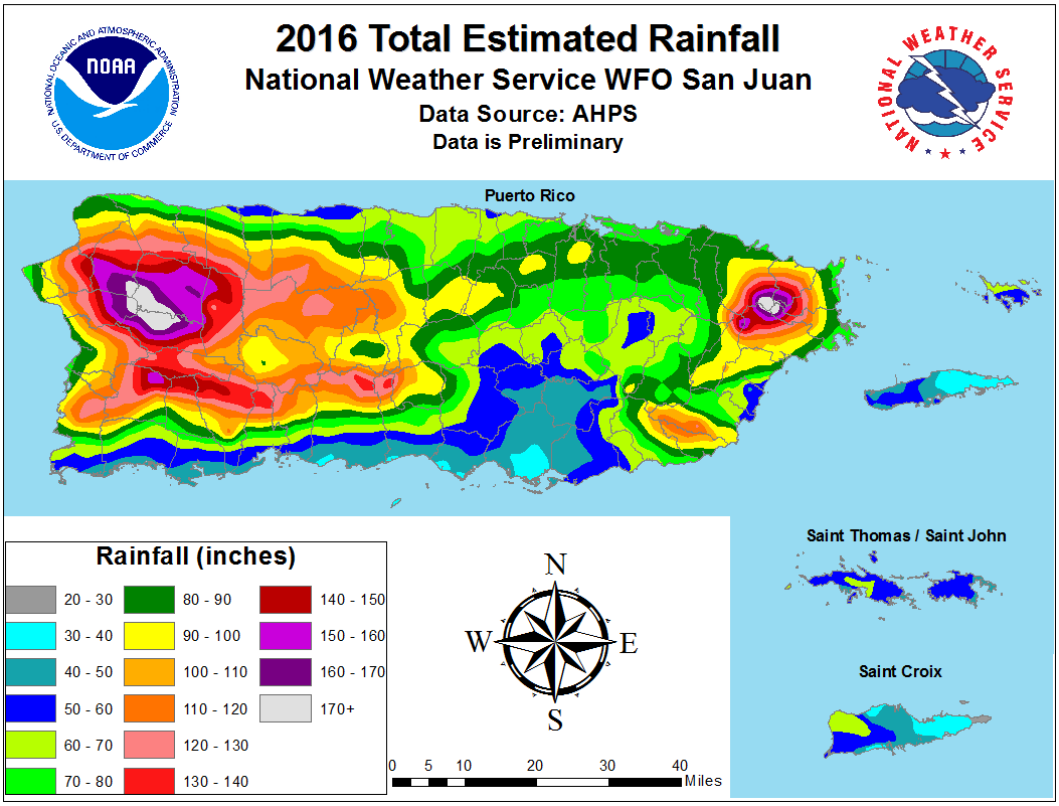


Figure 1. 2016 Total Estimated Rainfall

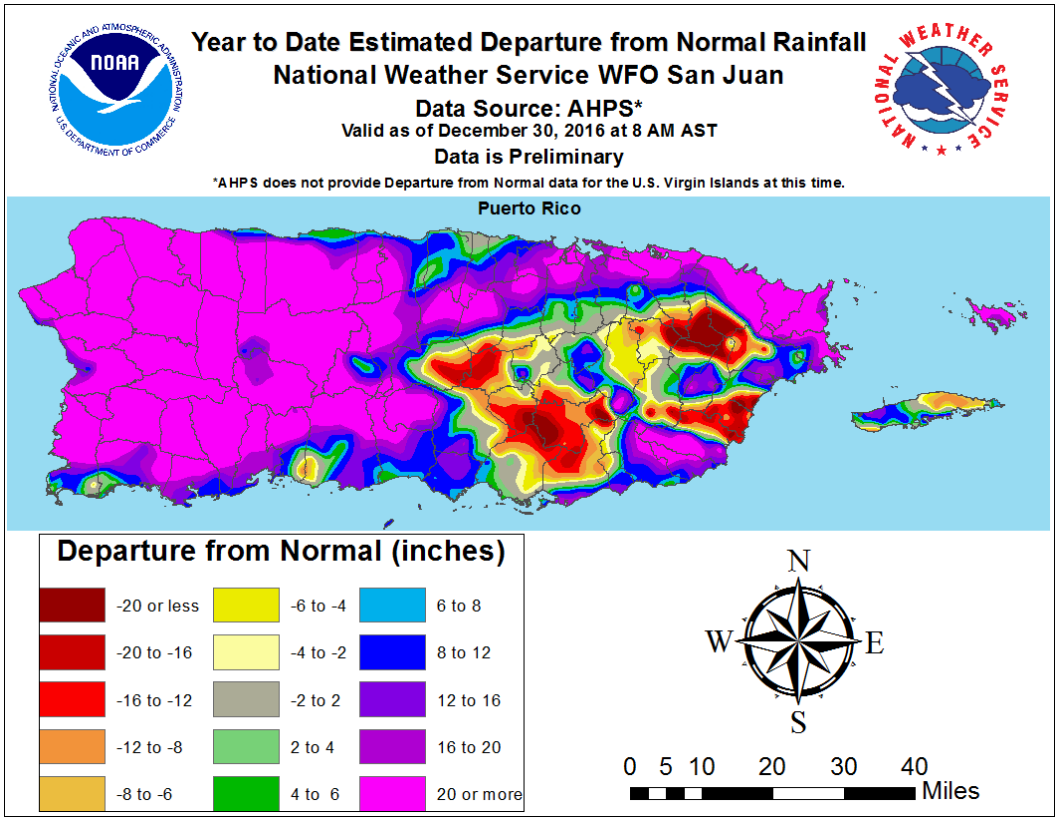


Figure 2. 2016 Departure from Normal

After El Niño reached its peak late in 2015, El Niño weakened to a moderate state by spring 2016 and dissipated by early summer. ENSO neutral conditions were observed late summer/early fall with La Niña conditions noted by late fall (Fig 4). In terms of Sea Surface Temperatures (SSTs); SSTs around the forecast area were above average much of the year (Fig 3).

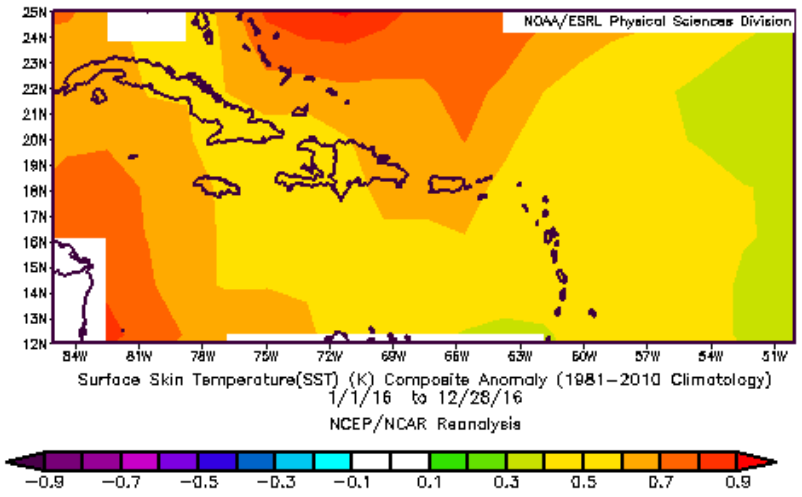


Figure 3. Sea Surface Skin Temperature (SST) Anomaly for the Caribbean from Jan 1 - Dec 28 2016.

Under a fading El Niño and ENSO neutral/developing La Niña, as well as above average SSTs, near to slightly above normal rainfall was observed early/mid 2016 with wet to extremely wet conditions observed during late fall. Although October and November are climatologically wet months across the local islands, October and November 2016 can be described as wet and extremely wet, respectively. Based on AHPS, 150 to 300 percent above the normal rainfall was observed during November. These showers and thunderstorms produced widespread urban as well as river flooding across most of Puerto Rico. Minor flooding was also reported across the outlying islands. These wetting rains alleviated the long-term drought, and after 157 weeks with abnormally dry and/or drought conditions, the U.S. Drought Monitor removed PR from its weekly assessment (Fig 5).

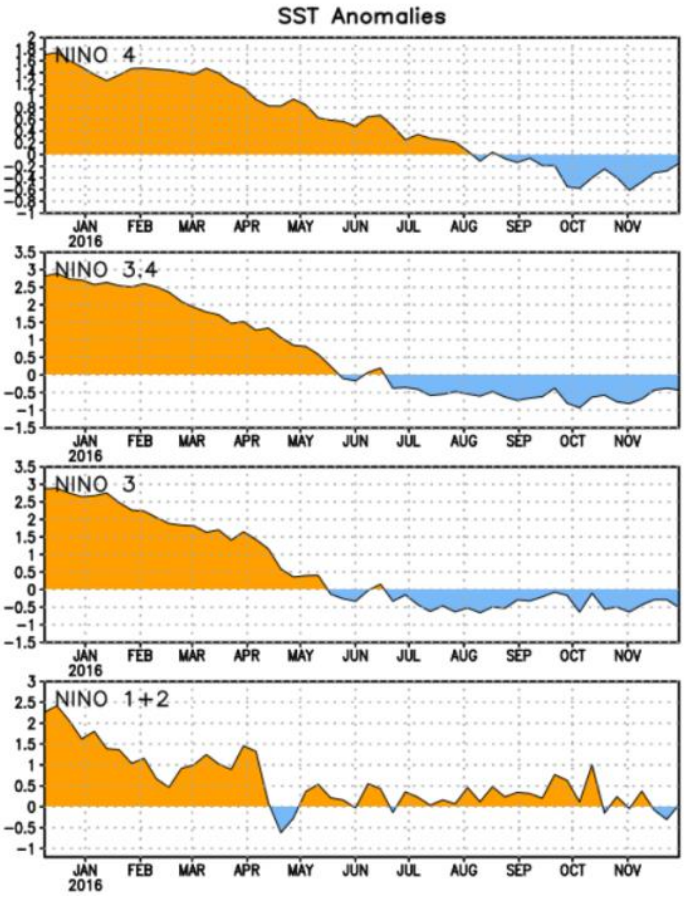


Figure 4. Time series of area-averaged sea surface temperature (SST) anomalies (°C) in the Niño. SST anomalies are departures from the 1981-2010 base period weekly means.

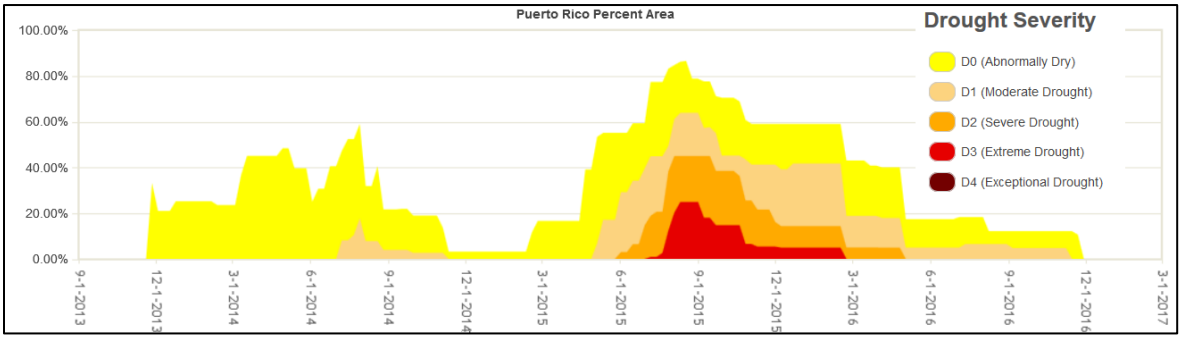


Figure 5. Percent Area of PR under USDM Drought Categories 2013-2016.

In terms of temperature, the mean annual temperature for Puerto Rico was 78.5ºF which is approximately 1.7ºF warmer than the 30-year average from the National Centers for Environmental Information (NCEI). Temperatures across Puerto Rico ranged from 99ºF in Aguirre on the 6th of September, to 52ºF in Adjuntas on the 15th of January. This pattern of above normal temperatures was observed across most of the Caribbean region (Fig 6).

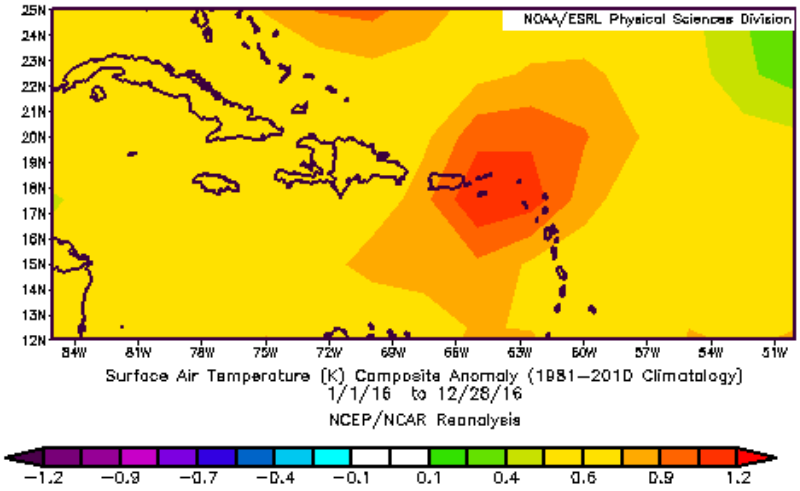
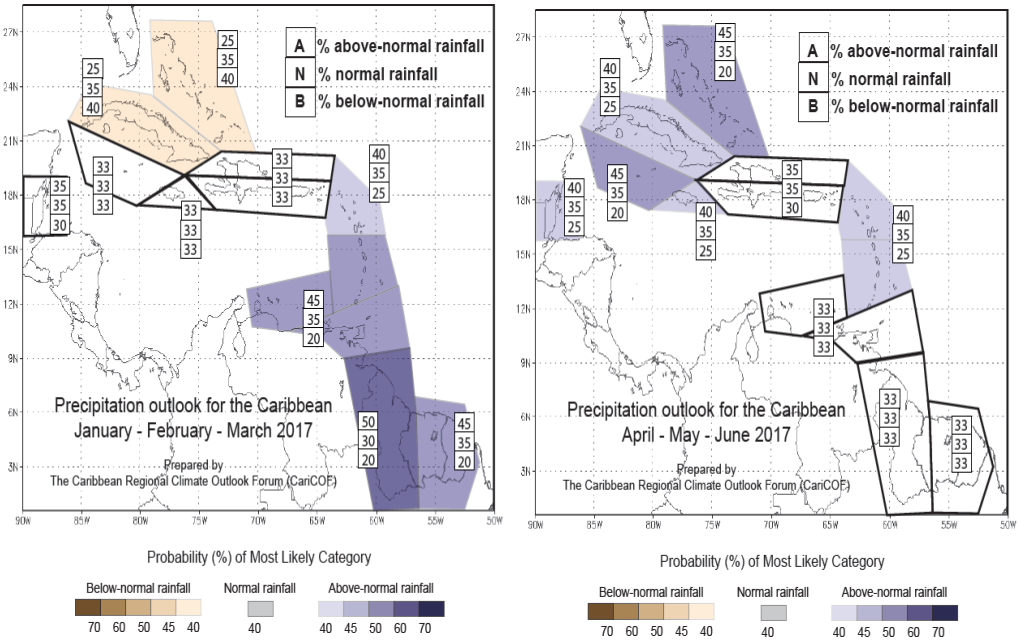


Figure 6. Surface Air Temperature Anomaly for the Caribbean from Jan 1 - Dec 28 2016.

Looking Ahead

La Niña conditions are present, with a transition to ENSO – neutral favored during January – March 2017. In terms of SSTs, Tropical North Atlantic SSTs tend to cool anomalously towards the end of La Niña, and are currently slightly above average throughout the Caribbean Islands. Small positive SST anomalies are expected to persist throughout the region and portions of the Tropical North Atlantic during Jan-Feb-Mar, but mostly fade by Apr-May-Jun. La Niña tends to shift rainfall chances for Jan-Feb-Mar to above-normal in the southern-most islands of the Caribbean, and below-normal in the Bahamas and Cuba. However, with the forecast ENSO conditions suggesting a weak La Niña at most, its effect on rainfall may not be dominant.



More Info: http://rcc.cimh.edu.bb/long-range-forecasts/caricof-climate-outlooks/

2016 Monthly Rainfall Accumulations.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Observed	2.52	4.01	3.81	6.39	6.36	4.75	6.59	7.78	6.03	10.33	11.79	3.85
Normal	3.33	2.60	2.86	4.68	6.98	4.53	5.01	6.01	7.81	7.94	6.69	4.06
% PON per month	**76**	**154**	**133**	**137**	**91**	**105**	**132**	**129**	**77**	**130**	**176**	**95**
Accumulated	2.52	6.53	10.34	16.73	23.09	27.84	34.43	42.21	48.24	58.57	70.36	74.21
Normal accumulation	3.33	5.93	8.79	13.47	20.45	24.98	29.99	36.00	43.81	51.75	58.44	62.50
% PON accumulated	**76**	**110**	**118**	**124**	**113**	**111**	**115**	**117**	**110**	**113**	**120**	**119**

Table 1. 2016 Rainfall Totals and Percent of Normal (PON) across Puerto Rico based on COOP.

At the primary climatological data sites, 126, 105, 91 percent of the normal rainfall was observed at Luis Muñoz Marin Airport (TJSJ) in San Juan, Cyril E. King Airport (TIST) in Saint Thomas, Henry E Rohlsen Airport (TISX) in Saint Croix, respectively. A preliminary rainfall total of 71.11 inches was measured at TJSJ, which is 14.76 inches above normal. A rainfall surplus of 2.46 inches and a deficit of 3.45 inches were observed at IST and ISX respectively. In terms of temperature, the mean annual temperature at TJSJ was 81.6ºF, which is approximately 0.6ºF warmer than the 30-year average from the National Centers for Environmental Information (NCEI). 2016 ended as the 6th warmest year on record at TJSJ. The mean annual temperature at TIST and TISX was 82.7 and 81.6ºF, which is 1.1 and 0.6ºF above normal.

Highlights for Primary Climatological Data Sites.

1. 2016 ended as the **year with the highest number of 80 degree nights** at the **Cyril E. King Airport in St Thomas.**

Rank	Year	Number of days
1	2016	116
2	2010	106
3	2015	94

2. November 2016 ended as the **2nd wettest month** for any given year at **Luis Muñoz Marin Airport.**

Rank	Month/Year	Amount
1	Aug 2011	18.56”
2	Nov 2016	17.65”
3	May 1936	16.88”

2016 Monthly & Seasonal Highlights for Primary Climatological Data Sites.

	Dec (2015)	Jan	Feb	Season
JSJ	5th warmest (80.0 ºF)	5th warmest (78.7 ºF) 7th driest (1.60")	7th warmest (78.9 ºF)	4th warmest (79.2 ºF)
IST	---	---	---	---
ISX	5th warmest (80.3 ºF)	9th warmest (78.8 ºF) 2nd driest (0.50")	6th warmest (79.2 ºF)	11th driest (4.41") 4th warmest (79.4 ºF)

Table 2. Winter 2015-16

	Mar	Apr	May	Season
JSJ	---	4th wettest (10.02")	---	---
IST	7th warmest (80.7 ºF) 10th wettest (2.43")	6th warmest (82.0 ºF)	3rd warmest (83.7 ºF)	5th warmest (82.1 ºF)
ISX	5th warmest (80.0 ºF) 10th wettest (2.39")	11th warmest (80.6 ºF)	---	8th warmest (80.9 ºF)

Table 3. Spring 2016

	Jun	Jul	Aug	Season
JSJ	9th warmest (83.8 ºF)	---	---	10th warmest (83.6 ºF)
IST	5th warmest (85.2 ºF)	---	5th warmest (85.5 ºF)	---
ISX	10th warmest (84.0 ºF)	10th warmest (84.3 ºF)	6th warmest (84.5 ºF)	7th warmest (84.3 ºF)

Table 4. Summer 2016

	Sep	Oct	Nov	Season
JSJ		7th warmest (83.8ºF)	5th warmest (81.4 ºF) wettest (17.65") 2nd wettest month for any given year	7th warmest (82.9ºF) wettest (28.95")
IST	4th warmest (85.1ºF)	4th warmest (84.0 ºF)	7th warmest 82.0F	5th warmest (83.7 ºF)
ISX		4th driest (1.39'')	---	---

Table 5. Fall 2016

	Dec	2016
JSJ	warmest 80.8 ºF	6th warmest 81.6 ºF
IST		
ISX	---	5th warmest 81.6 ºF

Table 6. December and 2016 Highlights

Additional Highlights Based on COOP Data

Wettest Days

Station	Rainfall	Date
WFO SAN JUAN	6.28	4/23/2016
RIO PIEDRAS EXP STN	6.12	7/14/2016
SAN JUAN L M MARIN AP	5.82	4/23/2016

Hottest Days

Station	Temperature (ºF)	Date
AGUIRRE	99	9/6/2016
LAJAS SUBSTN	96	9/30/2016
MAGUEYES ISLAND	95	9/30/2016

Coolest Nights

Station	Temperature (°F)	Date
ADJUNTAS SUBSTN	52	1/15/2016
PONCE 4 E	56	2/4/2016
LAJAS SUBSTN	60	3/8/2016

Data are preliminary and have not undergone final quality control by the National Centers for Environmental Information / NCEI/. Therefore, these data are subject to revision.

Puerto Rico Climate Record Period: 1940 to 2016
Luis Muñoz Marin Airport Climate Record Period: 1956 to 2016 (Primary climatological site)
Cyril E. King Airport/St Thomas Climate Record Period: 1953 to 2016 (Primary climatological site)
Henry E. Rohlsen Airport/St Croix Climate Record Period: 1951 to 2016 (Primary climatological site)
Missing data - Less than 10%